Intracranial Mechanical Recanalization and Fibrinolysis Using a Single Hyperglide Balloon Microcatheter

Technical Note

E. CASTRO REYES, F. FORTEA GIL, F. VILLORIA MEDINA, J. GUZMÁN DE VILLORIA, L. MUÑOZ ALMAZÁN, A. GIL NUÑEZ*, P. VÁZQUEZ ALLEN*

Hospital General Universitario Gregorio Marañón, Madrid; Spain
**Neuroradiology Section and Neurology Department*

Key words: fibrinolysis, stroke, balloon catheter

Summary

Endovascular treatment of acute blockage of the middle cerebral artery may require a combination of mechanical recanalization and chemical fibrinolysis. Using a single microcatheter to perform both techniques helps shorten procedure time.

Case Presentation

A 38-year-old woman was admitted to our hospital with symptoms consistent with acute ischemic stroke affecting the left middle cerebral artery (MCA). Onset was three hours and 15 minutes earlier. Clinical signs: mixed aphasia and hemiplegia. NIHSS score at admission was 16. A cranial CT scan revealed a blurred homolateral lenticular nucleus with no associated cortical lesion.

Based on the clinical and radiological findings and absent any causes for exclusion, our hospital's stroke team deemed the patient to be a candidate for intraarterial recanalization.

Diagnostic angiography was performed and showed a short M1 segment with complete occlusion of the anterior division, lateral lenticulostriate arteries, and the superior branch of the inferior division (figure 1).

Intraarterial recanalization was undertaken four hours and 45 minutes after stroke onset. No mechanical retriever device was available. A 6F Envoy guide catheter (Cordis Corp.) was positioned at the origin of the left internal carotid artery, and it was decided to perform primary mechanical angioplasty using a 4 x 15 mm Hyperglide balloon (Micro Therapeutics Inc.) mounted on a 0.012" 45º angled GT radiofocus guidewire (Terumo) under systemic heparinization. The guidewire was positioned distal to the thrombus, and the balloon was gently inflated manually within the thrombus twice, immediately re-establishing flow distal to the lateral lenticulostriate arteries and the superior branch of the inferior division of the MCA (figure 2). The patient exhibited immediate clinical improvement, with an 8-point reduction in the NIHSS scale on reexploration by the vascular neurologist in the intervention suite. However, a tendency towards reocclusion of the artery was observed, and consequently 17 mg of r-TPA (2 mg initial distal bolus) was infused for 75 minutes delivered through the Hyperglide microcatheter (figure 3). During infusion two additional mechanical angioplasty procedures were performed to treat reocclusion of the artery, without encountering any technical difficulties during inflation and deflation of the balloon using a 40:60 solution of 60% contrast medium and sterile saline. No additional arterial stenoses that might account for the tendency towards early reocclusion were observed.

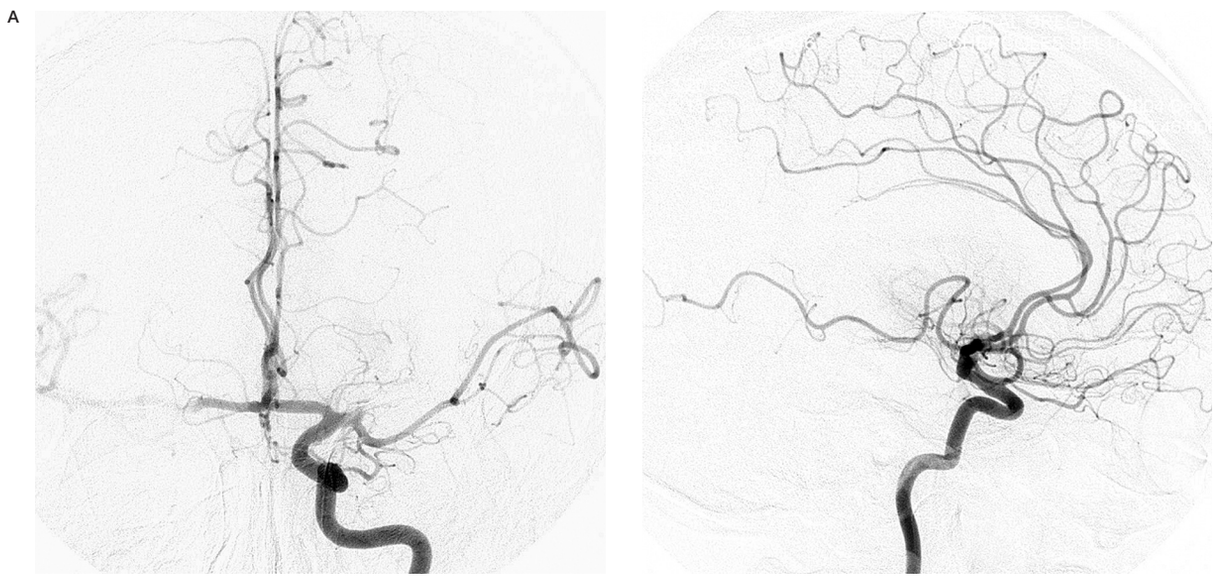

Figure 1 Initial diagnostic angiogram: AP (A) and lateral (B) views showing the occlusive TIMI 0-type lesion in the left MCA.

The final angiographic result was TIMI 2 over TIMI 0 at the beginning of the procedure, and the final NIHSS score was 8.

Discussion

Randomized trials have demonstrated the efficacy of intraarterial fibrinolysis in treating acute occlusion of the MCA [1].

Figure 2 Immediate angiographic result after two gentle manual inflations across the thrombus performed with a 4x15 mm Hyperglide balloon.

On the other hand, the need for or suitability of the systematic use of embolectomy and/or mechanical disruption has not yet been established, although preliminary data from some series of cases support the use of these methods, with or without associated chemical fibrinolysis, as a means of improving recanalization success rates and lowering haemorrhagic complication rates [2-4].

The development of techniques using balloon-assisted transitory occlusion to treat cerebral aneurysms has contributed to significant technical advances in equipment of this type [5-6]. The Hyperglide balloon system is a single lumen balloon that requires insertion of a 0.010" guidewire to occlude the central lumen to allow inflation of the balloon. When the guidewire's platinum coil tip is advanced distally to or past the catheter tip, it occludes the inflation holes, allowing the balloon to inflate. During preparation of these balloon systems, purging with a 50:50 solution of 60% contrast medium and normal sterile saline is required. During use the guidewire has to be kept distal to the microcatheter tip to keep blood from entering and degrading the system when the balloon is inflated and deflated.

In the case presented here, various technical modifications were made to the manufacturer's recommended conditions of use. The Hyperglide balloon microcatheter system was used both for primary angioplasty of the thrombus and as the microcatheter for local infusion of

the fibrinolytic agent, and infusion was alternated with two new angioplasties of the thrombus to treat recurrences of vascular occlusion. Removal of the microguide from the balloon system to allow infusion of the fibrinolytic agent and subsequent reinsertion to perform the new angioplasties did not cause any technical difficulties when reinflating and deflating the balloon, even though a certain amount of blood may have gotten inside the catheter.

The 0.012" Terumo guidewire used to manoeuvre the balloon intracranially was larger than the diameter recommended by the manufacturer for this type of balloon. Nevertheless, in our experience and in that of certain other experienced interventional neuroradiologists (S. Cekirge and I. Saatci, personal communication), its use can bring certain additional advantages to intracranial catheterization in selected cases thanks to the different angulations available. In such cases, as a precaution, the degree of dilution of the 60% contrast medium ordinarily employed (50:50) should be increased to 40:60 to facilitate deflation.

Potential use of microballoon systems with a Hyperglide guidewire could thus be expanded to include the treatment of acute cerebral ischemia where it is decided to carry out primary angioplasty of the thrombus, regardless of whether or not the procedure is combined with chemical fibrinolysis.

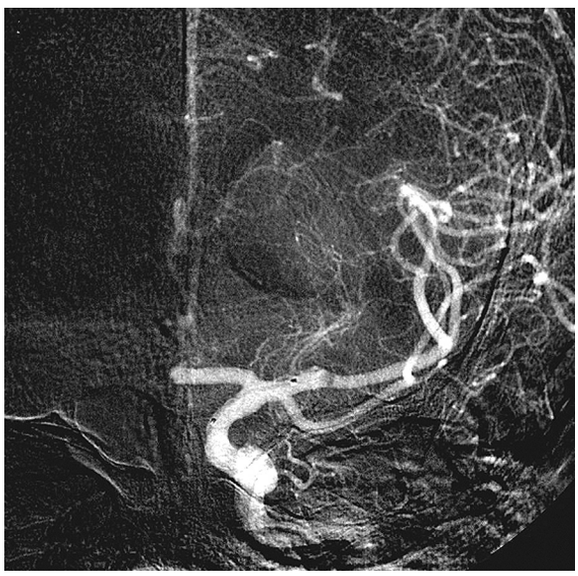

Figure 3 Infusion of r-TPA through the Hyperglide balloon proximal to the thrombus following mechanical angioplasty. Initial distal bolus was 2 mg r-TPA.

Conclusions

Primary angioplasty is a therapeutic option for treating acute cerebrovascular occlusions. The use of Hyperglide-type balloon microcatheters allows the procedure to be performed with or without chemical fibrinolysis using a single microcatheter.

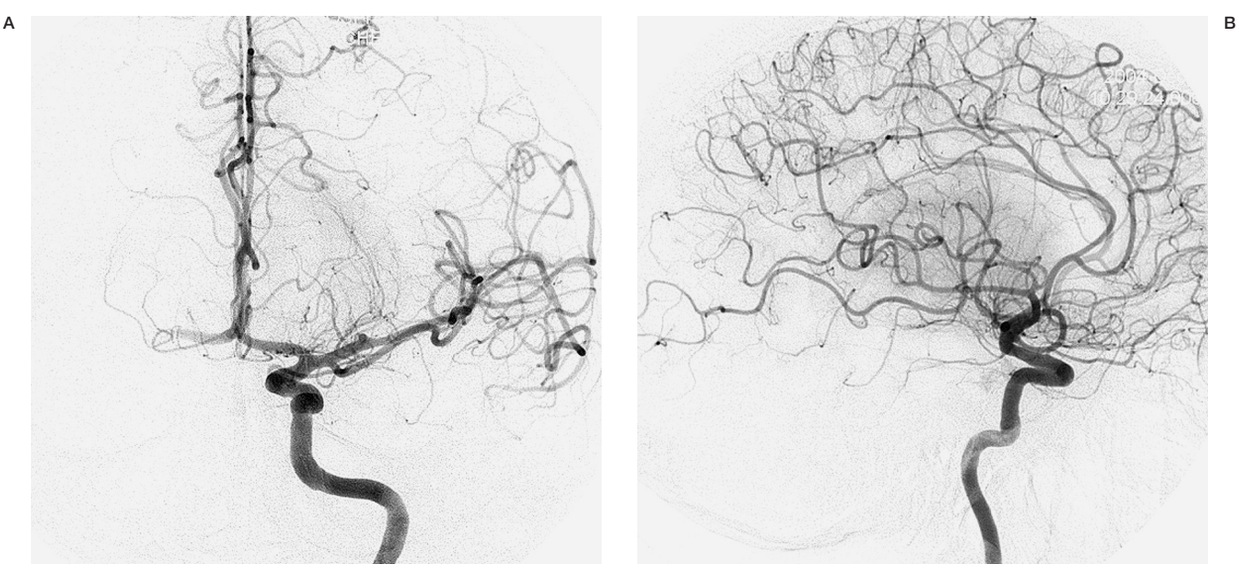

Figure 4 Final angiogram: AP (A) and lateral views (B) during complete opening of the posterior division of the MCA and M1 segment was achieved. Partial occlusion of the superior division continued, but strong leptomeningeal collateral circulation was visible.

References

1 Furlan A, Higashida R et Al: for the PROACT investigators. Intra-arterial prourokinase for acute ischemic stroke: the Proact II study: a randomized controlled trial. JAMA 282: 2003-2011, 1999.
2 Gobin YP, Starkman S et Al: Merci 1: a phase 1 study of mechanical embolus removal in cerebral ischemia. Stroke 35: 2848-2854, 2004.
3 Nakano S, Iseda T et Al: Direct percutaneous transluminal angioplasty for acute middle cerebral artery occlusion. An alternative option to intra-arterial thrombolysis. Stroke 33: 2872-2876, 2002.
4 Alexandrov A, Molina C et Al: For the Clotbust investigators. Ultrasound-enhanced systemic thrombolysis for acute ischemic stroke. New Eng J Med 351: 2170-2178, 2004.
5 Moret J, Cognard C et Al: Reconstruction technique in the treatment of wide neck intracranial aneurysms: long term angiographic and clinical results. Apropos of 56 cases. J Neuroradiol 90: 30-34, 1997.
6 Lubicz B, Leclerc X et Al: Hyperform Remodeling Balloon for endovascular treatment of wide-neck intracranial aneurysms. Am J Neurorad 25: 1381-1383, 2004.

Dr E Castro Reyes
Sección de Neurorradiología
Servicio de Radiología
Hospital Gregorio Marañón
Madrid, Spain
E-mail: ecastro.hgugm@salud.madrid.org